MAINTENANCE ACTIVITIES OF THE AMERICAN REDSTART

Millicent S. Ficken

The maintenance activities of the American Redstart (*Setophaga ruticilla*) were studied as part of a more comprehensive study of the behavior of this species. Marler (1956) defines maintenance activities as "those activities which are concerned with locomotion and the general health and efficiency of the body, mostly occurring throughout the year." Flight and flight intention movements are not included in this study.

Maintenance activities often serve as evolutionary precursors of signal characters (Daanje, 1950), and a study of such behavior is imperative for an analysis of the displays of a species. However, even those motor patterns which do not become display components are interesting from an evolutionary standpoint, and comparisons among related species are needed. They also may be useful as taxonomic characters. For example, the Columbidae and Pteroclidae can be separated from all other groups (Finn, 1919; Lorenz, 1956), except the estrildine finches (Poulsen, 1953), on the basis of their water-sucking method of drinking. In addition, a study of the ontogeny of maintenance activities furnishes insight concerning the development of behavior.

METHODS

Five adult redstarts were used in this study. They were fed Dandee Mynah Bird Food and the larvae, pupae, and adults of the wax moth (*Galleria mellonella*). In addition, seven young were removed from two nests at the age of six days and were hand-raised on a diet of earthworms, wax moth larvae, and vitamin supplements.

Data from a single captive Bay-breasted Warbler (*Dendroica castanea*) are included. It is impossible to make any conclusive comparisons using only one individual. However, there was very little individual variation in the redstarts studied, and this is probably true of the Bay-breasted Warbler as well.

Most of the observations on the redstarts were made using captive birds, but observations of adults in the wild indicate that these activities are not influenced by captivity, except for the fact that such movements as stretching, bathing, and various feather settling movements apparently occur more frequently in captive birds. This is probably because the birds are less occupied with foraging and other activities which take a large part of their time in the wild.

MAINTENANCE ACTIVITIES

Locomotion.—Redstarts hop forward when on the ground and sideways along a perch. They also have another locomotory pattern which is probably

a modified hop. I have termed this movement a "pirouette," and it involves a rapid turning movement in which a small, quick hop results in a 180° turn. The bird turns first one way and then the other and moves several inches during the process. Much of the movement along branches is by this method rather than by ordinary hopping.

Pirouetting has been noted in the Bay-breasted Warbler, the Blue-gray Gnatcatcher (*Polioptila caerulea*), and the Baltimore Oriole (*Icterus galbula*).

Pirouetting probably enables the bird to glance more readily in different directions as it moves along the perch. This would be advantageous in scanning the environment for food and predators. The Bay-breasted Warbler performs fewer and slower pirouettes than the redstart which is probably a reflection of its more sluggish feeding habits. Pirouetting was first noted in young redstarts three days after they left the nest.

Foraging.—Foraging was studied at Renwick, a deciduous woodland with much undergrowth, in Ithaca, New York. Here, the redstarts feed primarily 10 to 35 feet up, but occasionally feed on the ground or in low herbaceous plants. MacArthur (1958) studied their foraging range during the winter in Costa Rica and found it extended from 5 to 50 feet. Early in the morning the birds feed higher in the trees but by midday may be feeding near the ground. This shift probably reflects a change in the activity of insects. Redstarts procure food from the leaves, twigs, branches, and trunks of trees, vines, low herbaceous plants, and in mid-air.

Insects are obtained by gleaning, hovering, and mid-air catches. In gleaning, the bird moves along a limb or vine by pirouetting or hopping and picks insects off the leaves or branches. In hovering, the bird flies out (generally a short distance) and picks insects from the undersides of leaves while hovering under them with rapid wing beats. Mid-air catches are the usual method of obtaining flying insects and consist of flights from a perch out as far as 15 feet. Unlike some flycatchers (Tyrannidae), the redstart does not usually return to the point of origin of the flight, but continues feeding in a new location.

The Bay-breasted Warbler is rather sluggish in its movements as compared to most other warblers, and rarely uses its wings in foraging (MacArthur, 1958). The redstart, on the other hand, captures much of its food by mid-air sallies. If a fly or moth enters a cage with a redstart, the bird immediately captures it in mid-air. However, under similar circumstances, the Bay-breasted Warbler peers at the insect but rarely makes an attempt to catch it. It is possible that the Bay-breasted Warbler learns that it is generally too slow with its motor equipment to catch a flying insect while the redstart, on the other hand, is constantly reinforced with successful catches. Hinde (1959) states: "Structure and feeding patterns available influence the course

of individual learning, and are thus instrumental in controlling the food objects taken."

The highly diverse diet (Forbush, 1907; Benson, 1939) of the redstart is coincident with its variety of foraging methods and its wide vertical foraging range. Although the redstart is certainly a specialized feeder in that it is almost completely insectivorous, compared to other warblers (for studies of *Dendroica* spp. see MacArthur, 1958) it is broadly adapted within this category. The broad feeding adaptations of this species may help explain its extensive geographical range.

Ontogeny of feeding behavior.—Observations were made on four hand-raised redstarts. At eight days of age (one day before leaving the nest) the birds were noticed following moving objects with their eyes for the first time. The birds can fly as soon as they leave the nest. Not until they were 12 days old did they exhibit any intention movements to approach potential food objects. At this time, a young bird sleeked its feathers and crouched while watching a fly moving below him. At this age the birds lose interest in moving objects very quickly. Although moving objects were followed visually, the birds did not show much interest in still objects. At 13 days of age a bird picked up a bit of clay but soon dropped it. At 15 days of age a bird grabbed a squirming caterpillar from forceps held several inches away. The same day a bird leaned toward and snapped at a fly two inches away but missed. At this age the birds showed increased picking at motionless objects such as a nail head and bits of clay. At 18 days, a bird first made a flight toward a fly but did not succeed in capturing it. At 20 days of age the birds were still begging from me. When an insect that I was feeding them was dropped, they begged at it; then one picked it up and ate it. The birds finally fed independently at 30 days of age, which is about the same age that they become independent in the wild (Benson, 1939). The birds still directed food calls and wing flutterings at me but no longer gaped at me.

Treatment of food.—Different species of birds prepare insects for ingestion in diverse ways. The Red-eyed Vireo (*Vireo olivaceus*) and the Baltimore Oriole hold insects between the feet and the perch.

Another common method is holding the insect in the bill and banging the insect on a perch or on the ground. This method is employed by the American Redstart, Bay-breasted Warbler, and Yellow Warbler (*Dendroica petechia*). These species apparently never use the feet as an aid in feeding.

Two captive redstarts (both three to four months old) and an adult Bay-breasted Warbler were used for studies of food treatment. The pupae, adults, and particularly the larvae of the wax moth were used to study this behavior. The white larvae are soft-bodied and have a brown marking at the anterior end. The pupae are a fairly uniform brown and more heavily sclerotized.

Table 1
Treatment of Wax Moth Larvae

	Redstart No. 1	Redstart No. 2	Bay-breasted Warbler
Seizes at anterior end	14	50	50
Seizes at posterior end	1	0	1
Bangs anterior end	8	39	30
Bangs posterior end	8	26	8
Swallows anterior end first	9	36	40
Swallows posterior end first	5	11	2

The adult has a rather uniformly colored body and slightly mottled gray wings.

The treatment of larvae by both species is summarized in Table 1. Both species seize a larva by the thorax and squeeze it between the mandibles; this is probably an effective way of stunning it. The insect is held at a right angle to the bill.

The bird orients its body parallel to the perch. and bangs the larva on the perch with a whiplash action. The banging actually breaks the body of the larva, often spilling out the gut.

The differences in treatment of larvae by the two individual redstarts are small (Table 1). The differences between the redstarts and the Bay-breasted Warbler are more marked. The redstarts banged the posterior end of the larvae almost as frequently as the anterior end: the Bay-breasted Warbler banged the posterior end more infrequently. The Bay-breasted Warbler was more consistent in the end swallowed first. However. the end swallowed first may be modified by learning as is suggested by the fact that when redstarts were first given these insects they swallowed the posterior end first for the first eight or ten feedings. Then there was a gradual transition until swallowing head first became typical. The older Bay-breasted Warbler, however, did not swallow the posterior end first even initially, which may indicate that the bird had more experience in dealing with this type of insect rather than indicating any innate differences in the food treatment of these two species.

When a redstart flies out and seizes a larva as it is falling into the cage, it usually grasps it by the thorax, although sometimes it catches it by the posterior end. If the bird seizes the larva by the posterior end, he bangs the anterior end lightly several times on the perch. Since this is the reverse of what typically occurs, it indicates that subsequent acts are dependent upon the initial position in which the larva is held. In other cases, however, the bird initially grasps the posterior end, starts the "wrong" way, and then

"corrects" himself part way through the sequence. Thus there is not always a rigid sequence with successive patterns determined by the preceding ones. Rather, there is apparently some feedback of stimuli during the operation which sometimes results in adaptive corrections.

In both species, variation occurs in the amount of banging and the degree of completeness of the sequence. Hunger has an influence on food treatment. Birds were deprived of food (generally for about one-half hour) until they began performing intensive locomotory activity and also started giving "hunger" calls. The larvae were only banged in four cases in 19 trials. On the other hand in birds which were not deprived of food the larvae were banged in 11 out of 15 cases.

Another factor of importance in determining the relative completeness of the food preparation sequence is the size of the larva. Large larvae are generally banged while small ones are almost invariably eaten without previous treatment.

The factors causing redstarts to react to one end of the larva in preference to the other were investigated. Since live larvae were used, it was possible that the birds seized the end which was moving forward; so larvae were immobilized by drowning and then given to the birds. The anterior end was selected each time in 11 trials. Thus mobility is apparently not a feature determining the end seized.

Since there is a brown marking at the anterior end of the larva, color might serve as a cue. A simple experiment was performed to test this. A brown spot, made with liquid vitamins to which the birds had become accustomed, was placed on both ends of drowned larvae. In 14 trials the anterior end was seized seven times, the posterior end six, and the middle once. The birds thus showed no preference for either end. Twice an insect which was in a transition between the larval and pupal stages, and which was completely lacking in markings, was given to the bird and it was seized by the posterior end. Thus it seems that the bird directs its seizing response to the anterior end and the dark marking there serves as a releaser.

Tinbergen (1958) notes that hand-raised Yellowhammers (*Emberiza citrinella*) attacked mealworms by pecks aimed at the anterior or the posterior end, but slightly more often at the anterior end. However, mealworms are more uniformly colored than wax moth larvae and hence there are no distinctive markings to serve as releasers.

The birds often seized pupae by the middle and showed no apparent preference for either end; they were swallowed either anterior or posterior end first. This again would point to a distinctive marking as being the releaser for their more stereotyped behavior with the larvae.

Moths were almost always seized and swallowed anterior end first, but

the factors releasing seizure at the anterior end were not investigated. The size of the moth apparently has an important influence on treatment. In dealing with large moths, the bird holds the moth by a wing and bangs the body. Next, the bird drops the fragment of the wing which has broken off and grasps another wing and continues banging until most of the wings break off. The moth is then eaten. This elaborate sequence usually does not occur with small moths. Occasionally these were banged, but more often the bird held the body, not a wing, and the insect was then swallowed wings and all.

Stretching movements.—There are three stretching patterns in the adult redstart, and this is true for the other passerine species studied thus far (Nice, 1943). In one stretching pattern the wing is extended downward and outward from the body as the ipsilateral leg is lifted from the perch and stretched outward with the wing. During this movement the rectrices are also widely spread, apparently on the side that the wing and leg are stretched. Thus this pattern involves the stretching of a leg, wing, and the tail. This movement will be referred to as the wing and leg sideways stretch. Another stretching movement is the one referred to as the both wings-up stretch. Both wings (unfolded) are lifted simultaneously above the back. The third stretching posture involves an extension of both legs; this will be called the both legs stretch.

Young redstarts exhibit, in addition to the movements described above, a movement in which both wings are simultaneously stretched downward, but not stretched outward much. This pattern has also been noted in young birds of other species (Nice, loc. cit.; Andrew, 1956). Andrew notes that a tail stretch may be associated with this stretching posture in certain emberizines, but this was never seen in redstarts.

At the age of six days, when the young birds were first studied, they performed the both wings down, both wings up, and both legs stretches. Birds of this age, however, do not perform the wing and leg sideways stretch. This stretching movement first appeared at eight days of age, in the seven birds studied. It initially consists of one wing stretched downward close to the body and is thus apparently the same in form as the both wings down stretch except that only one wing is involved. The both wings down stretch decreases in frequency and was last seen on the same day that this new stretch first appeared. The both wings down stretch was never observed in adult redstarts and occupies only a short period in the young bird. This stretch only lasts two days in the Song Sparrow (*Melospiza melodia*) (Nice, loc. cit.). However, Andrew (loc. cit.) notes that adult buntings (*Emberiza* spp.) occasionally perform the both wings down stretch.

The both wings down stretch is apparently a transitional movement which gives rise to the wing and leg sideways stretch. This is indicated by the

initial similarity in form, and the fact that its appearance coincides with the disappearance of the other movement.

There is a pattern to the stretching movements and there are changes in the sequence during the life of the nestling. The both legs stretch is performed just as the bird completes the both wings down stretch in the six- and seven-day-old birds. Andrew (loc. cit.) mentions the same sequence in *Emberiza* spp. However, by the eighth day (and the last day that it is present) it is followed by the both wings up stretch more often than the both legs stretch.

The main difference in the stretching sequence of a Bay-breasted Warbler was that the both legs stretch appeared more frequently and was part of the wing stretching sequence, which did not seem to be the case in adult redstarts. The most frequent stretching sequence of the Bay-breasted Warbler is: both wings up. wing and leg sideways, both legs stretch. This sequence may be extended to include the other wing and leg in this type of sequence: both wings up, right wing and leg sideways, both wings up, left wing and leg sideways, both legs. The most frequent stretching sequence of the adult redstart is: both wings up, one wing and leg sideways. Andrew (loc. cit.) notes that in *Emberiza* spp. the wing and leg sideways stretch is usually followed by the both wings up stretch which is the opposite situation of the two warbler species. Marler (1956) found that after rest the Chaffinch (*Fringilla coelebs*) usually does a both legs stretch, one wing and leg sideways, followed by both wings up. Thus there may be species differences in the typical stretching sequence.

My findings are in accord with those of Andrew (1956) that stretchings occur most frequently following rest. The stretching movements are performed by the young bird when he awakes to be fed and generally more than one is performed at a time. Occasionally a bird will stretch after a period of locomotory activity, but generally only one stretch is given and apparently never more than three. After rest there are often sequences of four or five stretching movements. Andrew (loc. cit.) suggests that the preponderance of stretching movements following rest may be due to the fact that the bird becomes cramped while inactive and the stretchings occur because of proprioceptive feedback from the muscles.

There are at least two discernible intensities (degrees) of the both legs and the both wings up stretches. In the higher intensity of the both legs stretch the legs are stretched so far that the bird almost topples forward. If the bird performs the low intensity form of one of these stretches. it usually performs the higher intensity form in the same bout.

Resting.—The body feathers are fluffed in the resting bird. The bill may

point upward somewhat and the eyes may be closed for short periods, but the bird is still alert and looks around frequently.

Sleeping.—In adults, sleeping is preceded by the resting posture. The bird closes its eyes and the bill is often then rested on top of the scapulars. The bird may make several incomplete head turning movements before it finally rests its head there. Then with a quick movement the bill is tucked under the fluffed feathers.

In the course of ontogenetic development there are several changes in sleeping postures. Very young nestlings sleep with their heads and bodies flopped in almost any position. At six days of age the birds sleep with their heads turned sideways and often rest them against a nestmate. They also sleep with their necks outstretched and with the head resting on the rim of the nest. By eight days of age they often sleep with the head on top of the shoulder. However, the birds have not completely abandoned their earlier sleeping postures, but they have become more infrequent.

By the time that the young have left the nest at the age of nine days, they sleep solely in the adult manner. When birds of this age were awakened they usually turned the head to the opposite side when they went back to sleep again.

Dilger (1956) has described the sleeping postures of young Swainson's Thrushes (*Hylocichla ustulata*). These birds have a sleeping posture which is somewhat different from that of young redstarts. The neck is retracted and the bill is pointed upward (rather than horizontally or slightly downward as in the redstart). Otherwise the sequence of appearance and the form of the sleeping postures are similar.

It appears that sleeping postures are similar in most passerine species (Nice, loc. cit.; Dilger, loc. cit.; pers. obs.). Thus this is a very conservative behavior pattern.

Head-scratching.—Head-scratching is performed by placing the leg over the wing in all individuals of this species that were observed. Several species of Parulidae scratch under the wing, and there is often individual variation (Ficken and Ficken, 1958; Nice and Schantz, 1959).

The foot is used to scratch the chin, the cheek, the base of the bill, and the upper part of the neck as well as the head. The wing is usually drooped during this operation. There appear to be two different scratching postures. The first occurs when the bird scratches the crown (or possibly nearby areas). The crown feathers are erected and the bill is closed or opened only slightly, and the head is pointed downward or to the side. In the second scratching posture the neck is extended straight forward and the bill is opened widely. The feathers of the neck and head are generally sleeked. Both postures have also been seen in a Bay-breasted Warbler and the Ovenbird (*Seiurus auro-*

capillus). The eyes are often closed during head-scratching and this is evidently an adaptation to protect the eyes while the foot is brought into this area.

Since the bird is unable to reach the head area with its normal preening movements, there are two other movements which are used to remove foreign substances in this region. One of these is by rubbing the side of the head on the perch, the other involves scratching this area with the foot.

Head-scratching in the redstart occurs most frequently during preening bouts. It followed preening in 41 instances, stretching 12, and no other comfort movements preceded or followed in only 5 cases. Nice (1943) notes that in the Song Sparrow this activity frequently occurs after touching the uropygial gland, but this does not seem to be the case in the redstart.

Head-scratching was first noted in six-day-old young. At this time the movement is incomplete and the foot does not quite reach the head. The wing is first drooped and then the bird reaches over it with the leg. At seven days of age the birds were able to reach the head. Sometimes the young birds move the head during the scratching and the foot has access to several different areas. In older birds the foot is sometimes moved to several different areas during one scratching, but the head is not moved. For several days after they leave the nest, the young have trouble maintaining their balance during head-scratching since they must perform it while standing on one leg and no longer have the support of the nest. During this period the young birds often make several incomplete movements to scratch the head before they perform it successfully.

Bathing.—The bathing sequence of the redstart and the Bay-breasted Warbler is similar to that of the Song Sparrow (Nice. loc. cit.). First the bird dips the bill into the water and flips the water sideways. Then the bird with breast immersed in the water throws water over the back with motions of the wings.

Bathing was first noticed in hand-raised birds when they were 18 days old, although a bathing dish had been available prior to that time. Wing shuffling which typically occurs after bathing was first noted at 13 days of age after a young bird fell into the water, although he made no bathing movements at this time. An instance of "dry bathing" was noted in a 20-day-old bird. The bird performed all the typical bathing movements, including the wing movements, on the paper of the cage floor next to the bathing dish. This occurred just after the other bird in the cage had bathed. It is probable that the other bird in bathing splashed water on him and this stimulated the bathing. This particular bird had bathed in the normal manner several hours previously.

In the wild the birds bathe in shallow, sometimes quite muddy puddles.

A Bay-breasted Warbler was once observed performing bathing movements on a large wet leaf.

Post-bathing movements.—Wing shuffling starts as soon as the bird has completed the bath. The closed wings are moved upward and may extend outward from the body somewhat. In high intensities a whirring noise is produced and the force of the movements almost propels the bird off the perch. These wing shufflings are often performed in synchrony with rapid tail fanning. The tail fanning consists of rapid fanning of the rectrices and the outer feathers move slightly upward as they move outward.

A bird is often unable to fly immediately following a bath because of the wetness of the plumage, and then performs many wing shufflings on the cage bottom. Only when the bird is able to reach a perch does preening commence and then it is interspersed with wing shufflings which decrease as the bird becomes drier.

When fresh water is placed in the cage of a bird that has not bathed that day, the bird often immediately exhibits wing shufflings and tail fannings. These two movements may exist separately. When they occur together both movements are generally of the same intensity. Both of these movements may be given in conjunction with a body shake.

The drying movements of *Emberiza* spp. are described by Andrew (1956) and appear to be similar to those of the redstart and the Bay-breasted Warbler.

Body shake.—The feathers of the breast and back are fluffed and then the body is shaken. The feather erection component may be quite slight. The bird may fluff its feathers and then relax them without performing the body shake. The body shake apparently consists of two different components—the fluff and the shake. Wing shufflings may occur during the body shake as do tail fannings. Body shakes most frequently occur in context with other maintenance activities, particularly drying movements. Wing shuffling, body shakes, and tail fanning apparently function as feather settling movements (Andrew, loc. cit.).

Preening.—Preening consists of nibbling movements of the bill on a feather or several feathers. Preening movements are one of the first comfort movements to appear in the young bird. The exact time of their appearance was not obtained, but preening occurs before the young are six days old, even before the feathers have burst through the sheaths extensively. The adaptive significance of the early development of this movement seems clear. By preening, the birds aid in breaking the sheaths enclosing the feathers. Young birds occasionally grab plant fibers of the nest instead of feathers but they do not continue bill movements on these. It thus appears that there is some sensory feedback during preening.

The birds were first noted touching the uropygial gland with the bill when

they were 12 days old. The uropygial gland is touched soon after bathing, and less frequently during preening bouts at other times. The tail is spread and turned toward the head and the feathers near the gland are raised. The bird then obtains oil from the gland by touching it with the bill. Preening always follows. Andrew (loc. cit.) states that in *Emberiza* after oil is taken from the uropygial gland the bird often rubs its head on its shoulder which may transfer the oil. This movement did not occur in the two warbler species studied.

When the bird preens its primaries it moves from the base to the tip of the feather in rapid movements. The bird generally preens the primaries soon after a bath and performs wing shufflings in between preenings. The outermost primaries are preened first.

Tarsal preening.—On several occasions two captive redstarts ran their slightly opened bills the complete length of the tarsus and sometimes continued this movement down over the middle toe. This was observed during or just following the postjuvenal molt. Whitaker (1957) describes a similar movement in the Lark Sparrow (*Chondestes grammacus*), in which these movements followed touching the uropygial gland, and this was preceded by bathing. However, this was not the case in the redstart and it does not seem justified to term this movement oiling of the tarsus which is the function this movement seems to serve in the Lark Sparrow.

Cleaning the feet.—The feet are usually cleaned by the bird bending over and pecking the toes. However, on one occasion, a bird raised its foot about halfway to its bill and then pecked at the stationary raised foot. Whitaker (loc. cit.) describes a foot-cleaning method in the Lark Sparrow where the foot was raised and the bill lowered to meet it, but the bill and foot both made circular movements, and this was never observed in the redstart.

Bill-wiping.—This movement involves quick strokes of the bill on alternate sides of the perch. Bill-wiping generally follows feeding or drinking, and serves to remove foreign material from the bill. Food is also sometimes removed from the bill by a rapid sideways flick of the head. The young were first observed to bill-wipe at eight days of age, and they performed these movements on the nest rim after being fed.

Cleaning the base of the bill.—The feathers near the base of the bill and this area of the bill itself are cleaned by a slow rubbing of this area on the perch. The bill is usually opened during this action. This movement, unlike bill-wiping, often consists of only one such action, and the other side of the face is generally not rubbed.

SUMMARY

The maintenance activities of the American Redstart are described and their ontogeny traced wherever possible. A few observations of a Bay-breasted Warbler are included.

The redstart employs three prineipal foraging patterns: gleaning, hovering, and mid-air catehes. This variety of foraging behavior patterns is eoineident with a diverse insect diet.

The food treatment sequenee of the redstart is deseribed. The eompleteness of the sequenee is dependent on the degree of hunger and the size of the inseet. It was found using wax moth larvae that the brown spot at the anterior end serves as a releaser for seizure at that point.

The three stretehing movements of the adult bird are both wings up streteh, both legs streteh, and a wing and leg sideways streteh. In addition, the young bird performs a both wings down streteh whieh shows a transition in form to the wing and leg sideways streteh whieh soon replaces it. The stretehing sequenee follows a pattern whieh may be speeies-typieal.

The ontogeny of sueh aetivities as stretching, scratehing, and sleeping postures is marked by gradual ehanges. The young bird performs these in the adult form, before, or shortly after leaving the nest.

ACKNOWLEDGMENTS

I wish to thank Dr. William C. Dilger for his many helpful suggestions during the eourse of this study and for the eritieal reading of this manuseript. Dr. Sally Hoyt seeured several of the birds which were studied in eaptivity. I am indebted to my husband, Robert, for his eonstant eneouragement, suggestions eoneerning the manuscript, and assistanee in rearing the young birds. This study was aided finaneially by a Sigma Xi Grant-in-Aid and a Louis Agassiz Fuertes Memorial Grant.

LITERATURE CITED

Andrew, R. J.
1956 Normal and irrelevant toilet behaviour in *Emberiza* spp. *Brit. Jour. Anim. Behav.*, 4:85–91.

Benson, M. H.
1939MS A study of the Ameriean Redstart (*Setophaga ruticilla* Swainson). Unpublished thesis, Cornell Univ.

Daanje, A.
1950 On loeomotory movements in birds and the intention movements derived from them. *Behaviour*, 3:48–98.

Dilger, W. C.
1956 Hyloeiehlid thrushes in eaptivity with notes on their behaviour. *Avic. Mag.*, 62:183–189.

Ficken, R. W., and M. S. Ficken
1958 Head-seratehing in *Seiurus* (Parulidae) and other passerines. *Ibis*, 100:277–278.

Finn, F.
1919 Bird behaviour. London.

Forbush, E. H.
1907 Useful birds and their protcetion. Wright and Potter Printing Co., Boston.

Hinde, R. A.
1959 Behaviour and speciation in birds and lower vertebrates. *Biol. Rev.*, 34:85–128.

Lorenz, K.
1956 The objectivistie theory of instinct. *In* L'instinct dans le comportement des animaux et de l'homme. Masson et Cie., Paris.

MacArthur, R. H.
1958 Population ecology of some warblers of northeastern coniferous forests. *Ecology*, 39:599–619.
Marler, P.
1956 Behaviour of the Chaffinch *Fringilla coelebs*. *Behaviour* Supplement V.
Nice, M. M.
1943 Studies in the life history of the Song Sparrow II. *Trans. Linn. Soc., N.Y.*, 6:1–328.
Nice, M. M., and W. E. Schantz
1959 Head-scratching movements in birds. *Auk*, 76:339–342.
Poulsen, H.
1953 A study of incubation responses and some other behavior patterns in birds. *Vidensk. Medd. fra Dansk Naturh. Foren. bd.*, 115:1–131.
Tinbergen, N.
1958 Curious naturalists. Country Life Ltd., London.
Whitaker, L. M.
1957 Lark Sparrow oiling its tarsi. *Wilson Bull.*, 69:179–180.

Laboratory of Ornithology, Cornell University, Ithaca, New York, 24 April 1961

NEW LIFE MEMBER

Thomas G. Scott, Game Specialist and Head of the Section of Wildlife Research of the Illinois State Natural History Survey Division, is a new Life Member of the WOS. Dr. Scott is now retiring from the Chairmanship of the Society's Conservation Committee, a position he held for two years. Under his very active leadership, this committee's annual reports and special reports have summarized carefully the committee's detailed surveys of such current conservation matters as wildfowl conservation in North America, status and problems of North American grouse, effects of insecticides on terrestrial birdlife in the Middle West, trends in conservation education, and a general summary of the ornithologist's responsibility to the future. These interesting and pertinent reports already have had wide use, and requests for copies of the reports continue to be received.

Dr. Scott is a Fellow of the AAAS, a Life Member of the Society of Mammalogists, and a member of the AOU, the Wildlife Society, Ecological Society of America, and the Illinois Academy of Science. His research interests lie mainly in mammal and upland game bird ecology. To date he has published 65 papers and notes on various subjects related to these interests.